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Special Article - Seasonally adjusting the wage cost index experimental estimates

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INTRODUCTION

The Wage Cost Index (WCI) is one of the key quarterly economic indicators produced by the ABS. It provides a measure of changes in wage and salary costs in the Australian Labour Market, unaffected by changes in the quality and quantity of work performed. The purpose of this article is to provide preliminary estimates of seasonality in the WCI based on four years of data. The ABS will publish provisional seasonally adjusted WCI data later this year, when five years of data become available. These will only be provisional seasonal adjustments, at least for the first couple of years, because they are subject to possibly significant revision, potentially for the full length of the time series, as extra quarters are added to
the series over time.

In the headline WCI measure, wages and salaries refer to cash payments to employees and include ordinary time earnings, overtime earnings as well as the value of any salary sacrificed. The indexes were first compiled for December quarter 1997 (with a base of September quarter 1997 = 100.0).

The methodology used to construct the component indexes of the WCI is similar to that used for other price indexes such as the Consumer Price Index (CPI). Index numbers are compiled from hourly rates of pay for a representative sample of employee jobs within a sample of employing organisations. Individual indexes are compiled for various combinations of State/Territory, sector (public/private), broad industry group and broad occupation group. For more information on the methodology refer to Information Paper Wage Cost Index, Australia 2000 (Cat. no. 6346.0) and to view the quarterly data refer to **Wage Cost Index, Australia** (Cat. no. 6345.0).

TIME SERIES DECOMPOSITION

Any observation in a time series such as the WCI is attributable to three distinctly different notional influences:

- Seasonal Influences - systematic calendar related effects, such as pay reviews occurring at the end of the financial or calendar year;
- Residual Irregulars - unpredictable short term fluctuations in a series, not systematic or calendar related, involving one-off events such as delayed payments of safety net adjustments;
- Trend Movements - measures of the underlying behaviour of the series.

To understand the underlying behaviour of the original series over time and to assist in decision making, the ABS estimates and publishes seasonally adjusted and trend series for a wide range of time series. When a series is seasonally adjusted, estimates of the seasonal influences (i.e. systematic calendar related effects) are removed from the original data. The WCI seasonally adjusted estimates thus reflect the interaction of the underlying trend and all the irregular effects.

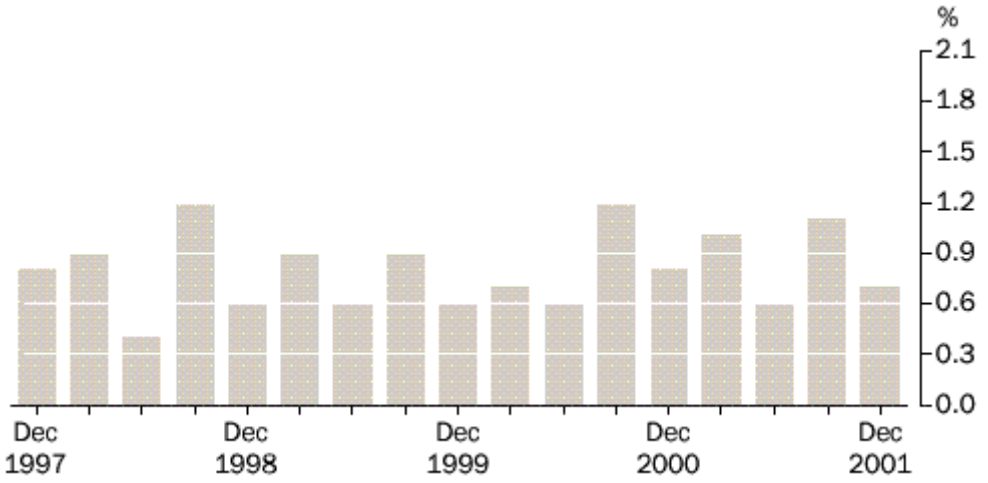
The ABS will not normally recommend a seasonally adjusted series for publication unless there are at least five, though preferably seven, years of quarterly data. This is the length of time required before the moving averages used in the seasonal adjustment process yield reliable results. Also, there must be significant peaks and/or troughs evident in the data on a regular basis for seasonality to exist.

Additionally, if the series is not stable the seasonal patterns are difficult to determine and in such cases the ABS may decide to wait for more data or to publish just a trend series. A trend series is one in which the irregular influences have been removed from the seasonally adjusted series; in other words, where both the systematic calendar related influences and the irregular influences have been removed from the original estimates.

In order to produce seasonally adjusted estimates the ABS uses an iterative X-11 procedure widely used by statistical agencies around the world. (See appendix for technical details of how the seasonal analysis is conducted using X-11.)

Throughout this article "first quarter" relates to the quarter from January to March, "second quarter" to the quarter from April to June, "third quarter" to the quarter from July to September and "fourth quarter" to the quarter from October to December.

GRAPH 1. QUARTERLY PERCENTAGE CHANGE,
Total hourly rates of pay excluding bonuses



Examining Graph 1, it appears that seasonality exists in the WCI data, with regular peaks in the first and third quarters and troughs in the second and fourth quarters. This pattern could partly be explained by evidence from WCI data collection that suggests the majority of salary reviews are undertaken either at the end of the calendar year or at the end of the financial year. The changes in pay relating to these reviews affect the first and third quarters of WCI. In addition, award/safety net adjustments mainly impact on the third quarter.

SEASONAL IRREGULAR CHARTS

An analytical tool used by the ABS to assess seasonality is to plot the de-trended data (with trend estimate removed from the original data). These Seasonal Irregular (S*I) charts plot each quarter

in separate panels. The "averages", within each quarter, of these S*I values is an estimate of that quarters seasonal factor. The seasonal factors are shown by the unbroken line and the S*I values by dots as shown in Chart 1. Due to the short span of data used, the seasonal factors are determined using a simple average as opposed to the more commonly used moving average for longer time series. As a result, the seasonal factors for each quarter are constant for all four years. The chart also shows the stability of the seasonal factors - the more the dots (each years S*I value) vary around the average line (the estimated seasonal factor), the less stable the seasonality in the series is, and hence the harder it is to estimate the seasonal factor reliably.

CHART 1: SEASONAL IRREGULAR CHART FOR MARCH

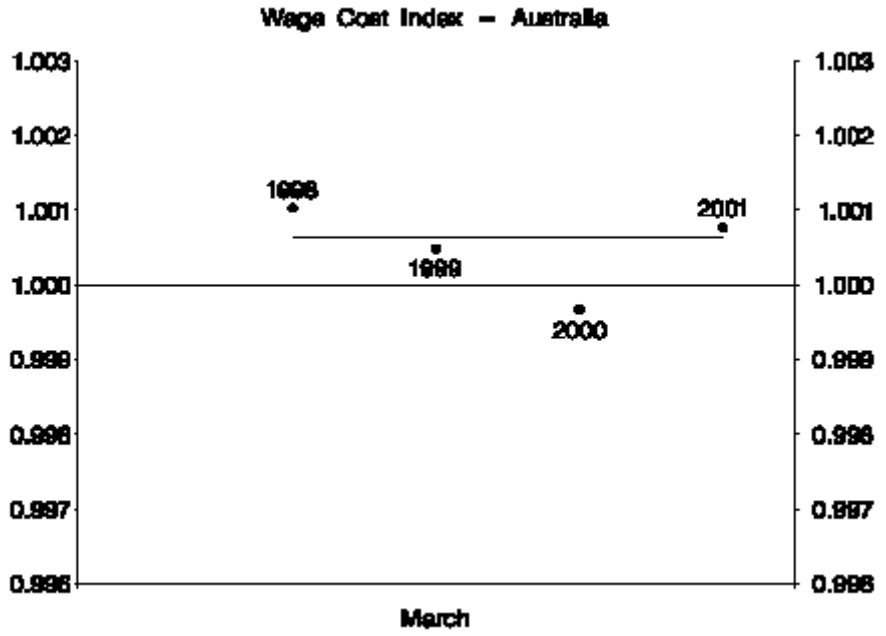
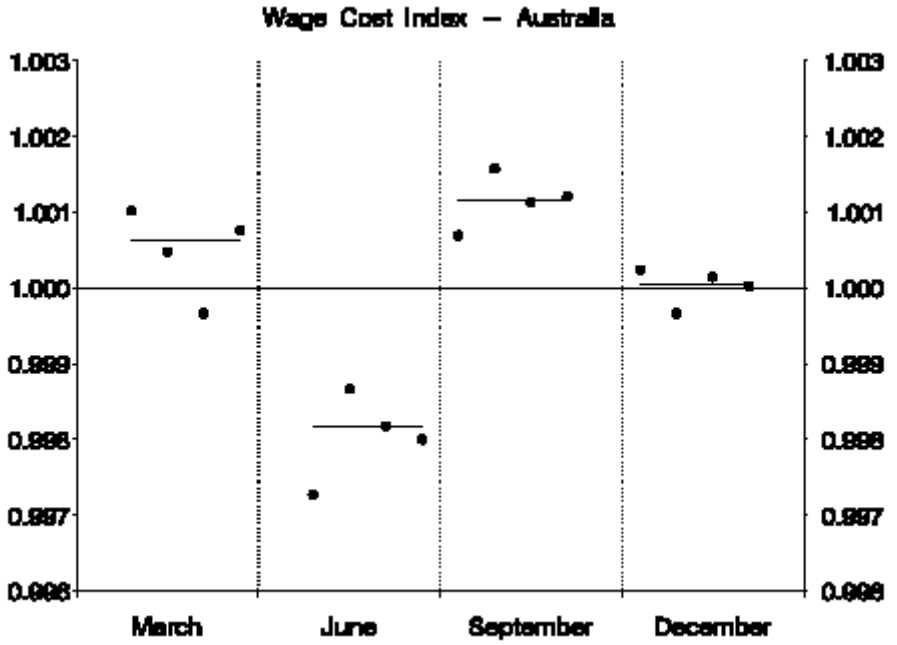


CHART 2: SEASONAL IRREGULAR CHART FOR WCI SERIES-Australia



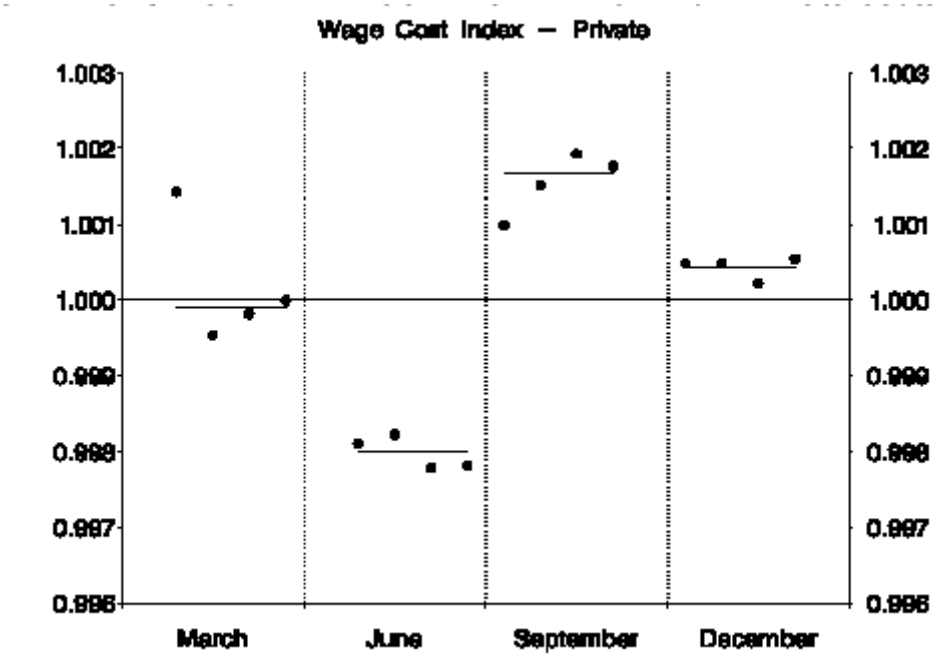
In the above chart the unity line (1.000) represents seasonal neutrality. Values above this line are seasonally high and represent peaks, and values below the line are seasonally low and represent troughs in the time series. When at least one panel displays significant and consistent evidence of seasonality a time series is deemed to be seasonal. The combined seasonal and irregular

factors (represented by dots) and the seasonal pattern (represented by the line) are plotted against the vertical axis. A seasonal low of 0.998 as in the second quarter indicates that the index number for this quarter is 0.2 per cent lower than for a seasonally neutral quarter.

Examining Chart 2, evidence of seasonality exists in the first, second and third quarters, with inconclusive evidence in the fourth quarter. A slight peak exists in the first quarter, but not as significant as the peak in the third quarter. Also a definite trough exists in the second quarter, again suggesting seasonality exists. Anecdotal and historical evidence from WCI data indicate increased activity regarding pay rises at the end of the financial year for employees on individual agreements and awards. With methods of setting pay in Australia estimated at 23 per cent for awards, 37 per cent for collective agreements and 40 per cent for individual agreements (source: Survey of Employee Earnings and Hours (SEEH), May 2000), the seasonal high in the third quarter is not surprising.

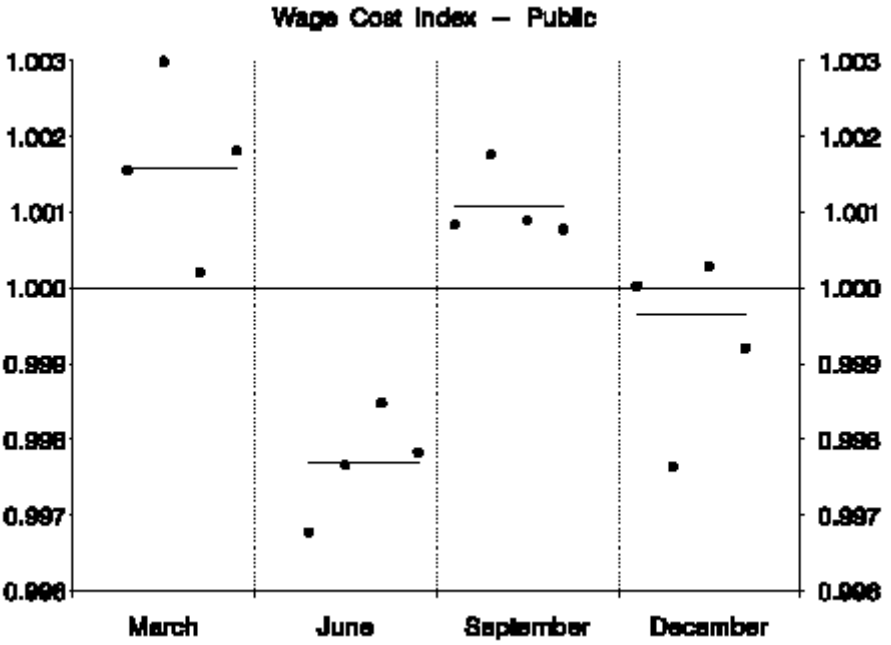
Looking individually at each quarter of Chart 2, the volatility/scatter appears to be insignificant, hence reasonably reliable estimates for the seasonal patterns can be extracted at the Australia level of WCI. The level of volatility is indicated by the distance the seasonal irregular dots are away from the seasonal patterns (represented by the line).

CHART 3: SEASONAL IRREGULAR CHART FOR WCI-Private Sector



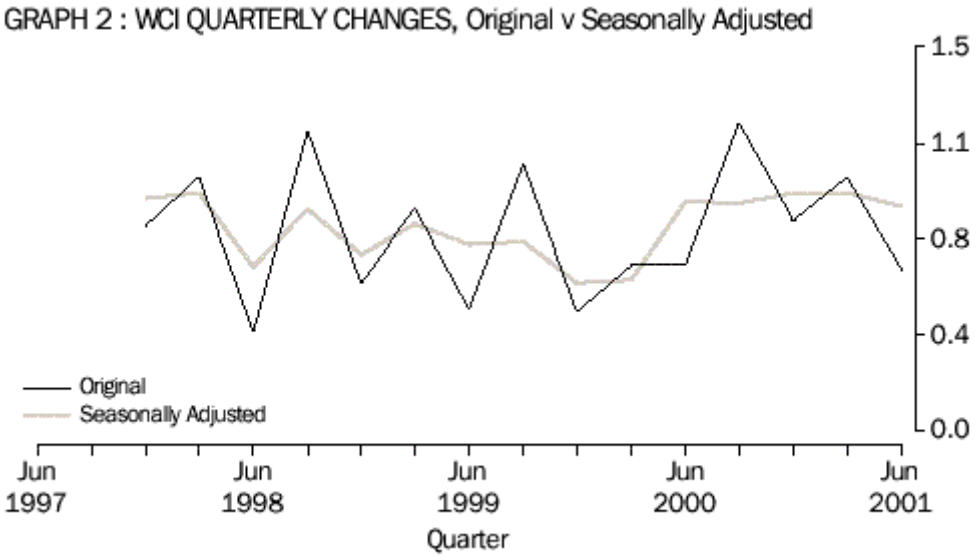
When the WCI series is broken down to the sector level interesting differences occur. For the private sector, it is apparent that the second quarter is seasonally low and the third quarter is seasonally high (see Chart 3). This pattern is consistent with the WCI at the Australia level, however, the size of the seasonal factors is larger for the private sector. While there is inconclusive evidence of seasonality in the first quarter, the fourth quarter indicates the possibility of a slight peak. Anecdotal and historical evidence from WCI data indicates that pay movements are mainly reported for employees on individual agreements and awards in the third quarter. This is consistent with data from SEEH, May 2000, which reports 49 per cent of employees are on individual agreements and 27 per cent are on award in the private sector.

CHART 4: SEASONAL IRREGULAR CHART FOR WCI-Public Sector



The public sector exhibits a slightly different pattern of seasonality from the Australia and private sector series (Chart 4). This may be due to the predominance of collective agreements as the pay setting mechanism in the public sector (85 per cent of employees (SEEH, May 2000)). When looking at public sector data only, there is evidence of a higher seasonal pattern in the first quarter than in the third quarter and evidence of low seasonality in the second and fourth quarter. However, there is some instability evident in the patterns for the public sector data which means the reliability of the estimated seasonal factors could be strengthened with a longer time series.

Graph 2 below, compares the WCI at Australia level, original and seasonally adjusted quarterly changes. The graph demonstrates how the peaks and troughs in the original data are smoothed by the seasonal adjustment process. The percentage movements in the original series are between 0.4 per cent and 1.2 per cent per quarter. The movements for the seasonally adjusted series are between 0.6 per cent and 0.9 per cent per quarter.



FUTURE PLANS FOR SEASONALLY ADJUSTED DATA

Whilst evidence of seasonality in the WCI data exists based on the experimental estimates produced and analysed in this report, it is also evident that the findings in some cases are affected by the instability of the series. It is expected that a longer time span would improve the estimation of seasonally adjusted series. Once five years of information is available following publication of June 2002 data the WCI series will be further analysed. If sufficient seasonality exists (and it is stable), the seasonally adjusted series will be published. Thus the first seasonally adjusted series of the WCI could be published in late 2002 when enough analysis has been completed for inclusion in the publication without impacting on release dates.

FUTURE WCI DEVELOPMENTS

Another major development for the WCI is its expansion to include Non-Wage Costs (NWC) from June 2002. Currently the WCI only reflects the change in the price of labour services measured by wages and salaries. However, the 1991/92 Major Labour Costs Survey showed that wages and salaries comprise 75 per cent of the total price paid by an employer to acquire labour services while the remaining 25 percent is comprised of non-wage items. Consequently, changes in the total price paid by an employer to acquire labour services should be improved by the inclusion of such NWC items.
Paid leave and Public Holidays, Superannuation, Payroll Tax, Workers' Compensation, Fringe Benefits and Fringe Benefits Tax are the items being considered for collection as NWC items. These items will be collected annually. Paid leave and Superannuation are scheduled to be collected from June 2002 with the remaining non-wage items subsequently implemented. Once three points of data have been collected NWC items will be published. This is expected to be towards the end of 2004.

FURTHER INFORMATION

For more information about the seasonal adjustment of the wage cost index, contact Robin Ashburn on (08) 9360 5936 or email **robin.ashburn@abs.gov.au**.

APPENDIX: X-11 PROCEDURE FOR SEASONAL ADJUSTMENT

The X-11 is an iterative procedure to produce seasonally adjusted and trend estimates. The first step is to estimate and then remove an initial estimate of the trend from the original data in order to produce a series that contains an initial estimate of the seasonal and irregular influences only. The series is then partitioned into quarters and the Seasonal-Irregular influences for each quarter are smoothed across the available span of data to obtain an initial estimate of the seasonal pattern. The first estimate of the seasonal pattern is then removed from the original series to leave an initial estimate of the seasonally adjusted series, which is in turn smoothed to obtain an improved trend estimate.

The process is repeated three times to obtain final estimates of the seasonal and irregular influences. The final step in the adjustment process is to obtain publication trend estimates by applying a 7-term Henderson moving average to the final seasonally adjusted series. The Henderson moving average is symmetric but as the end of the series is approached, asymmetric forms of the moving average have to be applied because future data points are not available. For further information refer to the Information paper **A Guide to Smoothing Time Series - Estimates of Trend, 1987 (1316.0)** and its companion paper **Time Series Decomposition - an Overview, 1987 (1317.0)**.

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